

REMARKS

Withdrawal of the finality of the Office Action, reconsideration, and allowance are respectfully requested.

The Finality Of The Office Action Should Be Withdrawn.

The Examiner alleges that the action has been made final because "Applicant's amendment necessitated the new ground(s) of rejection presented in this Office Action." In the last rejection, claims 30-34 were rejected for obviousness based on the combination of Ho et al. and Dowling. Applicants traversed and overcame that rejection not based on amendments added to the claims, but rather based on arguments. In addition, the Examiner for the first time rejected claim 29 under 35 U.S.C. §112, first paragraph. Although a §112, first paragraph rejection was made in the first Office Action at numbered paragraphs 2 and 3, claim 29 was not included in that rejection.

As set forth in MPEP 706.07(a):

A second or any subsequent action on the merits in any application...will not be made final if includes a rejection, or newly-cited art, of any claim not amended by applicant...in spite of the fact that other claims may have been amended to require newly-cited art.

Withdrawal of the finality of Office Action is respectfully requested.

The Rejections Should Be Withdrawn

The Examiner rejects claim 10 under 35 U.S.C. §112, second paragraph for indefiniteness noting an improper dependency in light of the cancellation of claim 2. Claim 10 has been amended to overcome this oversight so that it now depends on claim 1. Withdrawal of rejection under 35 U.S.C. §112, second paragraph is respectfully requested.

Claim 29 remains rejected under 35 U.S.C. §112, first paragraph, as allegedly being based upon a non-enabling disclosure. The Examiner apparently has misunderstood what Applicants are claiming. Claim 20 recites that the echo is cancelled in the frequency domain using a frequency domain model of the echo path channel. However, as explained in the seventh example embodiment, beginning at page 5, line 26:

when the transmitted symbols are not aligned in time with the received symbols or frames, an asynchronous echo canceller may be used. The asynchronous echo canceller may be combined with any previously-described example embodiment.

See also page 22, lines 3-21 and Figure 9. Because, this embodiment is protected in other dependent claims, e.g., claim 44, claim 29 has been canceled without acquiescing to the §112, first paragraph rejection, for reasons stated above, in order to advance the prosecution of this application. Withdrawal of the rejection under 35 U.S.C. §112, first paragraph is respectfully requested.

The Examiner has withdrawn the earlier prior art rejection based upon the Fertner patent. A new set of rejections has now been made based upon U.S. Patent 5,317,596 to Ho and 6,597,745 to Dowling. Specifically, claims 1, 3-7, 9-17, 20-43 stand rejected under 35 U.S.C. §103 as being unpatentable over Ho, and further in view of Dowling. This rejection is respectfully traversed.

The Examiner states that Ho's echo canceller is "configured to estimate and remove echo signals in the frequency domain" referring to Figure 3 in column 5, line 65 to column 6, line 22. Ho also requires a time-domain echo canceller. See, for example, the time domain echo, $e(n)$, being subtracted from the received signal at summer 52 in Figure 3. Moreover, the abstract description of Ho's echo cancellation includes:

converting the frequency-domain transmit block to a time-domain transmit block, subtracting the end of the previous time-domain transmit block from the end of the current time-domain transmit block, performing a convolution of the adjusted time-domain transmit block and the time-domain echo parameters to produce a time-domain echo, subtracting the time-domain echo from a time-domain receive block of a received signal, converting the resulting signal to the frequency domain to produce a frequency domain receive block.

See also column 4, lines 34-42; claim 6, lines 10-13; and column 7, lines 10-14 and 25-44.

The Examiner admits that the Ho fails to disclose "that the echo signals are estimated with a combination of both a product of a first matrix and transmitted symbol and a product of a second matrix and a previously transmitted symbol." For this deficiency, the Examiner relies on newly-cited Dowling.

Dowling *precodes* a signal *before* the signal is transmitted in order to compensate for channel distortion. The hope is that this precoded signal will be received without the receiver having to process it, using for example, an equalizer. In contrast, the instant claims are concerned with removing echo in the near-end transceiver caused by the transmitted signal, while Dowling precodes the transmitted signal in order to simplify signal processing in the far-end transceiver.

There is a fundamental problem with applying Dowling to the instant claims. Apparatus claims 1-34 relate to an echo canceller, and method claims 35-44 describe estimating echo signals in the frequency domain and using that estimated echo to reduce the echo in a received signal. Dowling's invention has nothing to do with an echo canceller or echo cancellation.

Dowling's precoder does not estimate and remove an echo signal from a received signal. Dowling's goal is to precode the transmitted signal in such a way that the distortion Dowling believes will be introduced by the channel will be minimized. The channel distortion model does

not include echo cancellation. Echo is caused by impedance mismatches, which is different from the channel transfer function.

The Examiner makes passing reference to column 22, lines 1-3, where Dowling states that "communication systems often involve other elements such as echo cancellers which may be advantageously merged with the precoder." This text actually undermines the position taken in the Office Action. Although Dowling's precoding techniques may in principle eliminate or reduce the need for time-domain equalization and frequency domain equalization (TEQ and FEQ), Dowling's invention does not perform echo cancellation. Dowling's precoder could be used on the transmit end together with an echo canceller used on the receive end. But this option does not in any way mean that Dowling's precoder remedies the admitted deficiencies with respect to Ho's echo canceller.

Even if Dowling's precoder were combined with Ho's echo canceller, one would not arrive at claim 1. By the Examiner's own admission, Ho fails to disclose estimating echo signals frequency domain using the echo estimation matrix products recited in claim 1. Dowling does not disclose in any detail an echo canceller. Dowling certainly does not teach estimating echo signals in the frequency domain for use in an echo canceller to remove the frequency domain that estimated echo from an received signal using the combination of matrix products recited in claim 1.

The Examiner errs in arguing that implementing Dowling's "precoder's functionality with Ho's echo canceller" produces an echo signal "for the advantage that the precoder (and as such, the echo canceller) takes into account ISI and ICI (noise)." Dowling's precoder does not produce or otherwise estimate an echo signal that is used by an echo canceller to remove an echo from a received signal. It is unreasonable to argue that Dowling's transmitter precoder, when "merged"

with an echo canceller in the receiver, some how becomes part of the echo canceller. The precoder is separate from the echo canceller and does not perform echo cancellation.

Like claim 1, Dowling fails to disclose an echo canceller recited in claim 20 for "canceling an echo from a received signal" or for determining "an estimate of the echo in the received signal using a frequency domain model of an echo path channel that takes into account effects of inter-carrier interference and to subtract the echo estimate from the received signal." Neither Ho nor Dowling disclose an echo canceller that takes into account effects of inter-carrier interference in a frequency domain model in an echo estimate so that it can be subtracted out from the received signal. Claim 30 is distinguished for the same reasons as claim 20 with the additional feature that the frequency domain estimate of the echo takes into account both the effects of intersymbol interference and inter-carrier interference. Claim 35 is distinguished from the combination of Ho and Dowling for reasons recited above with respect to claim 1.

Claims 18 and 19 stand rejected under 35 U.S.C. §103 as being unpatentable over newly-cited U.S. Patent 5,117,418 to Chaffee et al in view of Dowling. This rejection is respectfully traversed.

Chaffee discloses an echo canceller in which the estimated echo is converted to the time-domain and subtracted from the received signal. The Examiner admits that "Chaffee does not disclose that the echo signals are estimated with a combination of both the product of a first matrix and transmitted symbol and a product of a second matrix and a previously transmitted symbol." Again, the Examiner relies on Dowling. The reliance is misplaced for the reasons explained above. Dowling's precoder is not an echo canceller. Nor does Dowling describe calculating a product of a first matrix of coefficients and a currently-transmitted symbol combined with a product of a second matrix and a previously-transmitted signal "to estimate an

echo signal in the frequency domain, which is then removed from the received signal in the time-domain." Dowling's precoder does not estimate an echo signal and does not remove an echo signal from a received signal. Nor has the Examiner made clear how Chaffee and Dowling could be combined. Chaffee describes a time-domain echo canceller, and Dowling describes recursive precoding in the frequency domain. It is unclear how that combination would result in Chaffee's echo canceller having improved performance.

Many of the dependent claim features are also distinguishable over the applied prior art. Because the primary rejections fail to disclose or suggest the claimed echo canceller, it is unnecessary to address these additional distinguishing features.

The application is in condition for allowance. An early notice to that effect is earnestly solicited.

Respectfully submitted,

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